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CAULIFLOWER AND HEADING BROCCOLI PRODUCTION

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Although there are some minor differences in appearance, cauliflower and heading broccoli are identical botanically; therefore, for practical purposes they may be considered the same, with the exception that heading broccoli requires a full growing season of 6 to 10 months, whereas cauliflower reaches the heading stage in from 100 to 150 days. In this leaflet they will both be referred to as cauliflower.

Importance of Cauliflower Production

Cauliflower was formerly of little commercial importance in the United States, but it has gained in popularity, largely because of better transportation facilities and better seed stocks, until in 1936 it occupied about 29,020 acres; approximately 6,908 carloads were marketed in 1936. Production regions are roughly divided into three groups: (1) Fall and winter, including Arizona, California, Oregon (fall), and Texas, with 8,800 acres; (2) early, including California (spring) and Oregon (spring), with 8,650 acres; and (3) late, including Colorado, New York, New Jersey, Utah, and Washington, with 11,570 acres. Certain other States also contribute to the total production.

Climatic Adaption and Soil

Cauliflower requires a cool climate, and it will not develop satisfactorily if exposed to high temperatures or if there is lack of moisture. Regions where the atmosphere is humid and cool because of latitude, altitude, or proximity to water are essential to the successful production of this crop. The intensity of the industry in the coast regions of California, on Long Island, in the Adirondack section of New York, and in the high-altitude section of Colorado clearly shows the importance of these factors.

Cauliflower is not sensitive to the type of soil on which it is grown, but it must be well drained and fertile. In character, the soils may vary from heavy clays to sandy loams and peats, but they must supply the plant with optimum conditions, especially in regard to plant food and moisture.

Fertilizers and Manures

Experimental work both in the East and in the West indicates the desirability of using manure on land for cauliflower; it further shows that this material should usually be supplemented by applications of commercial fertilizer. In general, 20 to 30 tons of manure per acre may be advantageously used, provided it can be obtained at

a reasonable cost. On soils into which large quantities of green crops have been incorporated, the quantity of manure might be reduced or even be omitted entirely. In California, it has been found that in general it is the lack of nitrogen that limits the growth of the cauliflower plant. California College of Agriculture Circular 11, *Cauliflower Production in California*, suggests the use of 70 to 80 pounds of nitrogen to the acre before planting, with a later side dressing of 100 to 150 pounds of nitrate of soda if the plants show a yellowish color. In New Jersey it was found that manure supplemented by 1,000 pounds per acre of a 4-8-4 complete fertilizer, together with a side dressing of nitrate of soda, gave good results. The same rate of application of this complete fertilizer, supplemented by two side dressings of nitrate of soda, without manure, also gave good results. It was also found that applying the fertilizer in two portions, one before planting and the other after the crop was set, gave better results than single applications. New Jersey Agricultural Experiment Station Bulletin 432, *Spring Cauliflower in New Jersey*, advises the use of from 1,500 to 2,000 pounds per acre of a 4-8-4 mixture, broadcast before planting, supplemented by side dressings of 150 to 200 pounds per acre of nitrate of soda for situations where the manure supply is limited. For general conditions, good results may be obtained by using 15 to 20 tons of manure per acre and a 4-8-4 to 5-10-5 mixture of commercial fertilizer at rates varying from 1,000 to 1,500 pounds per acre, supplemented by one or two side dressings of nitrate of soda or sulphate of ammonia at intervals of 1 and 2 months after planting. It is suggested that the commercial fertilizer be applied in the row, a part before planting (mixed with the soil) and the remainder as a side dressing a few days after planting, or that the entire amount be broadcast before the plants are set.

Seasons for Cauliflower in the Various Regions

Carlot shipments of cauliflower, by months, from the various producing areas furnish a good indication of the seasonal distribution of the crop. The data for 1935 (table 1) from Market News Service, Bureau of Agricultural Economics, United States Department of Agriculture, include only a few of the more important areas, but these supply the bulk of the crop.

TABLE 1.—*Carlot shipments of cauliflower from the more important producing areas, 1935*

State	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Arizona	27											15	42
California (southern district)	48	1	4	57	27						78	597	812
California (central district)	932	1,038	718	638	306	50		7			39	289	4,008
Colorado								288	343	114	7		752
Maine							4						4
New Jersey										8	9		17
New York (Long Island)										51	398	3	452
New York, other									20	9	7		36
Oregon	1	2	19	34					4	51			111
Utah									3	17			20
Washington						63	70	3					136
Total	1,008	1,041	741	729	333	113	74	298	370	250	538	895	6,390

Varieties, Seed, and Time of Planting

With cauliflower, like most other crops, the character of the particular strain is of more importance than a varietal designation, but the following are well-known varieties that are extensively grown: Early cauliflower—Early Dwarf Erfurt, Early Snowball, and Early Pearl; late cauliflower—Late Pearl and Autumn Giant; heading broccoli—St. Valentine and Matchless White.

Cauliflower seed of merit, being difficult to grow, is high in price, but considering the relatively small quantity of seed required to produce enough plants for an acre, the highest quality seed does not demand a very large outlay of money. Most of the seed on the market is imported from Denmark, where conditions are suitable for cauliflower-seed production. In recent years some seed has been grown in this country, especially in greenhouses and in the vicinity of Los Angeles, Calif. Practically all of the commercial cauliflower production of southern California is grown from locally produced seed. Experimental work carried on in the Bureau of Plant Industry shows that greenhouse production of cauliflower seed is not a difficult matter. Individual plants yielded from 2 to 2½ ounces of seed, or at the rate of about 2 pounds of seed to each 100 square feet of greenhouse space. Figure 1 shows a head of cauliflower, grown for seed purposes.

The date of planting is determined by the climatic characteristics of each region and the time needed for the variety to reach marketable condition. In regions where the winter crop is grown, seed sowing begins with the first early varieties about May 15 and continues with later sorts until about the middle of August. Shipment from the early planting begins about November, and that from later plantings continues throughout the winter. For complete information on cauliflower production in California the reader is referred to the California circular, previously mentioned. The winter and the early crops overlap, a portion of the latter coming from plants set in the fall and a portion from frame-, greenhouse-, or outdoor-grown plants set in the field during the early spring. One of the latter methods is quite generally followed throughout the North and East for spring cauliflower. The long-season kinds, referred to as heading broccoli, are seldom suitable for culture in regions where they cannot be planted in the fall because they do not have sufficient time in the spring to develop before the arrival of hot weather.

Success with spring cauliflower usually depends on the selection of varieties that grow quickly and in starting the plants and setting them as soon as the soil and weather conditions will permit. In the latitude of Washington, D. C., cauliflower seeds may be started indoors about the middle of February and the plants set in the open ground about the first of April. Success with these plantings requires the use of well-hardened plants. In most sections it is practically useless to attempt the culture of spring cauliflower unless it is started early. The late crop is usually set in the field about mid-summer, about the same time as late cabbage. It is successful only in sections having cool autumns, due either to latitude or elevation. The success of the cauliflower industries of Long Island and Erie County, N. Y., and the mountainous sections of Colorado is due largely to their cool autumns.



FIGURE 1.—Head of cauliflower grown in a greenhouse for seed production.

Sowing the Seed and Setting the Plants

Cauliflower plants are grown in the same way as cabbage plants. When started in the greenhouse or hotbed, the seeds are drilled in rows 6 or 8 inches apart. They may be transplanted, but this is usually impractical on account of its cost. With thin seeding—that is, 3 or 4 seeds to the inch, and careful management of the temperature and moisture of the plant beds, good plants may be grown without transplanting. In California the plants are grown in beds about 18 inches wide with irrigation furrows between. The rows of plants are about 12 inches apart. In the South the plants are grown in the field during the winter in drills 8 to 12 inches apart. These plants are being extensively used for spring planting in regions farther north. The chief precautions to observe in growing cauliflower plants are to avoid stunting in the seedbed and to have them well hardened or accustomed to field conditions before they are set out.

The plants are set in the field in the same manner as cabbage, in rows wide enough for cultivation, with the plants about 18 to 30 inches apart in the rows, the distance depending on the variety. When grown under furrow irrigation, the plants are set either in the bottom of the furrow, on the side of the ridge near the bottom of the furrow, or in some other manner that will be suitable for irrigation. California Circular 11, previously mentioned, advises against frequent superficial irrigations, as they encourage shallow rooting. A thorough soaking at less frequent intervals is regarded as better. The same suggestion applies equally well to overhead irrigation, which is extensively used throughout the South and East.

Plants set when the ground is well supplied with moisture will usually start promptly and make a good growth. Irrigation makes it possible to set plants at almost any time that temperatures are suitable.

Cultivation and Care

The cultivation of cauliflower is similar to that of other row crops, such as cabbage. It is limited to weed control and the maintenance of a soil mulch.

When the cauliflower heads or "buttons" begin to form they are usually given protection from the weather and light by tying the long leaves together over the heads. The field must be gone over two or three times at weekly intervals, because all the plants do not reach the heading stage at the same time. In order that the heads of different stages of maturity may be distinguished at cutting time, they are tied with material of different colors, by means of which different stages of development are indicated. Cutters, however, soon learn to judge the stage of development of the heads by the feel and general appearance.

Diseases and Insects

Damping-off, black rot, blackleg, and clubroot are the principal disease troubles affecting cauliflower. Damping-off and wire stem may be controlled by using sterilized seedbed soil and by care in watering and ventilating the plants or by watering the plants in the seedbed 4 to 6 days after they are up with a 1-to-2,000 (1 ounce to 16 gallons of water) solution of corrosive sublimate (mercuric chloride) and repeating the treatment at weekly intervals for 4 to 6 weeks or by dusting with mercury dusts. Treating the seed with 1-to-1,000 (1 ounce to 8 gallons of water) corrosive sublimate solution for 30 minutes has been found effective against blackleg and black rot. For clubroot, seedbed disinfection and crop rotation or treatment with hydrated lime at the rate of 1,500 to 2,000 pounds per acre are the best remedies when combined with crop rotation. For further information on the control of diseases write to your State agricultural experiment station, or to the United States Department of Agriculture for Farmers' Bulletin 1439, Diseases of Cabbage and Related Plants.

The common cabbage worm, the cabbage looper, the cabbage aphid, the cabbage maggot, and cutworms are serious pests with which the grower of cauliflower has to contend. For information on the control of these insects on cauliflower write to the United States Department of Agriculture or to your State agricultural experiment station. Farmers' Bulletin No. 1371, issued by the United States Department of Agriculture, contains information on the diseases and insects of garden vegetables.

Harvesting and Packing

In harvesting and preparing for packing, the heads are severed with several of the large leaves adhering, and these are trimmed so as to project an inch or two beyond the head. In some cases they are trimmed to the desired length for packing when cut; in others the final trimming is done during packing; in either case these jacket

leaves are left long enough to give good protection to the head. It is necessary that the heads be cut while still compact and free from "riciness." It is generally considered a better policy to harvest the heads when in prime condition regardless of size, because if the plants have not made good growth the heads will not grow large regardless of the time they remain in the field. Figure 2 shows heads of cauliflower in prime condition for marketing.

In California, the principal cauliflower shipping State, the standard crate has inside measurements of $8\frac{1}{2}$ by 18 by $21\frac{5}{8}$ inches. In the important Long Island, N. Y., district a crate with inside dimensions 13 by 15 by $21\frac{5}{8}$ inches is in general use, and in western New York a "cradle" crate measuring 8 by $13\frac{1}{2}$ to 18 by $22\frac{3}{8}$ inches is often used.

The heads must be set erect, all at a uniform height in the crates, and the leaves trimmed off level about an inch or two above the top of the crate and the slats nailed on to hold them in place. When packed in the car, the crates are placed bottom side up, and for long-distance shipment or when otherwise necessary, ice is placed between the tiers and on top of the load. Water from the melting ice runs off the leaves rather than coming in contact with the heads.

A complete statement of the United States standards may be obtained from the Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D. C.



FIGURE 2.—Heads of cauliflower in prime condition for marketing.